Project Summary

US Army Engineer
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Waterways Experiment Station

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Predictive Model for Spillway/Channel Erosion

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Objectives: Rock surface spillway erosion causes problems in many dams in all parts of the country. The US Army Engineer Waterways Experiment Station (WES) is working to advance the predictive modeling of rock surface spillways/channel erosion.

Problem: The assessment of the erosion problem on limited service spillways addressed in Engineering Manual 1110-2-1603, Hydraulic design of Spillways, Chapter 5.6, states "The designer must not only decide whether the channel materials will be eroded but also make reasonable estimates pertaining to the rate at which erosion will progress." The other section of the same paragraph admits that "Guidance on erosion progression is limited." There is no formal design guidance in erosion prediction for rock surface limited service spillway/channels. The only existing design manual, which was prepared by US Department of Agriculture (USDA), is primarily applicable to soil surface spillway/channels. The US Army Engineer District, Kansas City (KCD) has modified the USDA erosion model to assess rock surface spillway erosion. This modified model compared favorably with the observed erosion data from Tuttle Creek Dam during the flood event of 1993.

Approach: WES will further improve the modified KCD erosion model by incorporating spillway erosion case histories from other dams in the US as well as elsewhere. For the present time, the KCD model can be used to predict head-cut advance of spillway erosion by accepting its limitations.

During FY 98-99, WES is collecting spillway erosion case history data from the Corps of Engineers dams and other sites in the US. These data include information on the layout of the limited service spillways, cross sections of the spillway channels, engineering geology and material properties of spillway channels, energy dissipation systems, past flood discharge(s), and damage(s) on the spillway channel caused by specific floods (head cut erosion). These data are being use to improved the KCD spillway erosion model. The improved KCD erosion model shows that beside the improve threshold line, there is a threshold zone that may be used to assess the spillway erosion risk analysis. The draft input for guidance documents may be developed for future update of the existing Engineering Manual 1110-2-1603, Hydraulic Design of Spillway.